Stay Tuned:
Sound Waveform Models

If you throw a rock into a calm pond, the water around the point of entry begins to move up and down, causing ripples to travel outward. If these ripples come across a small floating object such as a leaf, they will cause the leaf to move up and down on the water. Much like waves in water, sound in air is produced by the vibration of an object. These vibrations produce pressure oscillations in the surrounding air which travel outward like the ripples on the pond. When the pressure waves reach the eardrum, they cause it to vibrate. These vibrations are then translated into nerve impulses and interpreted by your brain as sounds.
These pressure waves are what we usually call sound waves. Most waves are very complex, but the sound from a tuning fork is a single tone. In this activity you will analyze the tone from a tuning fork by collecting data with a microphone.

OBJECTIVES

- Record the sound waveform of a tuning fork.
- Analyze the waveform to determine frequency, period and amplitude information.

MATERIALS

- computer
- data-collection interface
- Vernier Microphone
- tuning fork or electronic keyboard

PROCEDURE

1. Connect the Microphone to the data-collection interface. Connect the interface to the computer.
2. Open LoggerPro software on your computer. For this experiment, the default data-collection parameters for a Microphone will be used (Rate: 10000 samples per second; Duration: 0.03 seconds). The number of points collected should be 301.
3. To center the waveform on zero, you need to zero the microphone channel. With the room quiet, choose Experiment > Zero.
4. If you are using a keyboard, set it to a flute sound. Use middle C as the note. If you are using a tuning fork, strike it against a soft object such as a rubber mallet or the rubber sole of a shoe. Caution: Striking it against a hard object can damage it. If you strike it too hard or too softly, the waveform may be rough.

   Produce a sound with a tuning fork or keyboard, hold it close to the Microphone and start data collection.

5. After data collection ends, a graph will appear. Check with your instructor if you are not sure if you need to repeat data collection. If you need to repeat data collection, repeat Step 4.

DATA TABLE

Period	
Amplitude A	
Frequency	

ANALYSIS

1. Click any data point and use examine button to examine the data pairs on the displayed graph. Record on the line below the times for the first and last peaks of the waveform. Record the number of complete cycles that occur between your first measured time and the last. Divide the difference in time by the number of cycles to determine the period of the waveform. Record the period in your data table.

2. Trace across the graph again, and note the maximum and minimum y values for an adjacent peak and trough. Calculate the amplitude of the wave by taking half of the absolute value of the difference between the maximum and minimum y values. Record the amplitude, A, in your data table.

ANALYSIS QUESTIONS

1. The frequency of a sound wave is the number of cycles per second. The period is the number of seconds per cycle. Explain the relationship between frequency and period.

   The unit hertz, or Hz, is equivalent to cycles per second. Calculate the frequency of the sound wave in Hz and record it in the data table.

2. The amplitude of a sound wave increases with the loudness of the sound. Explain how you could alter the value of A if you repeated this investigation.

3. Pitch is associated with the frequency of the tuning fork. A higher pitched tone would have a higher frequency. Explain how your graph would change if you used a tuning fork of higher frequency.

   How would the value of the period change if the frequency were higher? Explain your reasoning clearly.